

# A2 Assignment – ESE516-SPRING 2019

**DUE DATE: MONDAY FEBRUARY 11<sup>TH</sup> 2019 before 11:59pm EST (By almost midnight). To be submitted on Google Drive**

**Remember:** Please submit an excel sheet for your SAMW25 Pin Mapping

## 1.) Assigning the pins to your MCU [50 Points]

Now that you have your design and the major ICs you are planning to use, it is time to determine the pins of the SAMW25 to determine your pinout. You will need to be very careful with this step, so please take the time to double check and verify that your pinout assignment is correct!

First, use Atmel Start (<https://start.atmel.com/>) to double check that your pin assignment is correct. Please start from the "" (Browse Examples – search for Get Weather Winc1500 and select the SAMW25 Xplained Board). This example add the USART on SERCOM4 (for CLI) and the internal SPI bus connected to the winc, PLUS SOME GPIO needed to control the WINC. These pins must stay the same! Other pins are fair game, and you can use them.

**Tip: Add peripherals you need using the button “Add software Component”**

**Tip: If you need to add an GPIO interrupt, add the Software Component “External IRQ”**

**Tip: To save, you can download the file using the “Save Configuration” file. You will need to submit this file**

Once you have a pin assignment ready, save the file and fill out the excel sheet available alongside this instruction file: ESE516\_SAMW25\_PinAssignments\_V1.xlsx on Google Drive

### Your Task:

- 1.) Save the Atmel Start configuration and rename it to “GROUPNAME\_ESE516\_SPRING.atstart”
- 2.) Please fill out the file “ESE516\_SAMW25\_PinAssignments\_V1.xlsx”:
  - On the “PIN PLACEMENT” tab, please fill out the form:
    - Place team name and member name on the top.
    - Place link to your Atmel Start Project (Remember to save to get your unique project to share!)
    - Please fill the columns E, F and G (INFORMATION RELATED TO OUR DEVICE).
      - **Function (Column E):** The function of the pin (Example: GPIO Input, I2C SDA, Interrupt, SPI MOSI, etc.)
      - **Peripheral (Column F):** If it has a function, place the HW peripheral name here. This helps avoid repeats and possible collisions! Example: SERCOM1, EXTINT6, etc. For gpio say GPIO).
      - **Component Connected to device (Column G):** Mention the component connected to your device on those pins. For example: HDC1080 Temperature Sensor. Please don't just say “temperature sensor” – add MPN.
    - **Add your updated BOM to the tab “Updated BOM” on the format we used on A0. Please add any comments that were made to your project on said deliverable.**

## **DELIVERABLES ON YOUR GROUP'S GOOGLE FOLDER, A2 FOLDER:**

- **Atmel start configuration**
- **Excel Sheet**

## 2.) Reading questions [25 Points]

Please do the following readings to get a better understanding of the power system.

Read Sections 4, 8, 10, & 11 of Atmel-42618-SmartConnect-ATSAMW25-MR210PB\_Datasheet.pdf

Read Sections 4 & 9 of Atmel-ATWINC1500B-MU-Y-datasheet.pdf

Read Sections 6, 35, & 37 of Atmel-ATSAMD21G18A-AU-datasheet.pdf

### **Your Task:**

Answer these comprehension questions in a word document (Submitted individually in your group folder)

- What is the difference between recommended and absolute ratings?
- What is the maximum voltage you can apply to a pin on the SAM W25? What is the power supply voltage in that case?
- For the SAMW25, what is the difference between the VBATT & VDDIO pins?
- What voltage will you supply to these?
- How much current do you anticipate to be drawn in the highest current draw situation?
- Why might you want to use separate voltage sources for VBATT & VDDIO?
- How many reset lines are on the SAM W25? What does each do?
- Given what you know about button debouncing & default pin states, what additional circuitry would you put on these reset pins? Note: include a physical button for manual resets.

### **Deliverables:**

Please answer these questions individually. Submit a word document with your answers in the format "ESE516\_YOURNAME\_A2.docx"

## 3.) Altium Components [50 Points]

For your project, please generate the Altium Parts for all your components on your BOM that are sensors, drivers, or other ICs that you are going to use. Please note that you do not need to do the part for the SAMW25 – we will give that to you.

- Please search first on Altium's Content Vault. If it is there then there is no need to add it – please make a note on your BOM if that is the case. SnapEDA may also have your component available, free of charge. It

is recommended to always check any downloaded schematics & footprints against the datasheet -- you need to ensure you don't have any issues.

**Your task:**

Generate the Altium Files for your component. Submit the Altium Schematic Library and Altium PCB Library.

**Deliverables:**

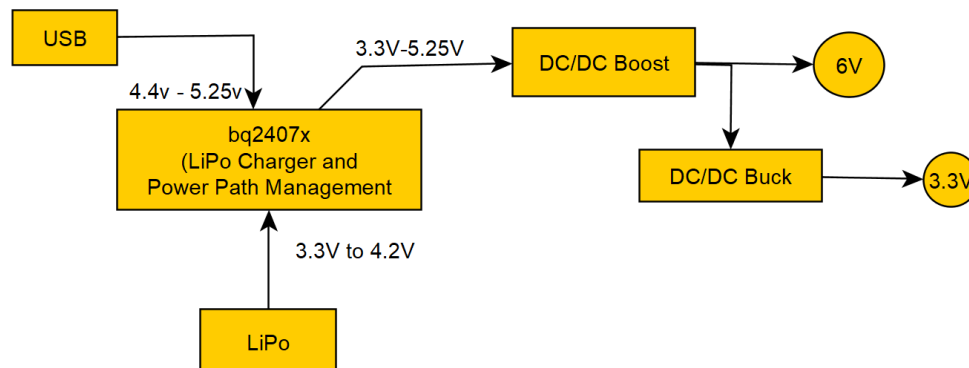
Submit the Altium Schematic Library and Altium PCB Library for your components. If you can find them made in the Altium vault, make a note on the BOM.

## 4.) Power Architecture [75 Points]

Using Webench power designer (<http://www.ti.com/tools-software/design-center/webench-power-designer.html>) , design your power architecture and submit the following.

**Your Task:**

- Block diagram of power architecture (similar to this example). If you are using a LiPo battery, please use the following scheme with the BQ24075 (<http://www.ti.com/product/BQ24075>)



- Design using webench: <http://www.ti.com/tools-software/design-center/webench-power-designer.html> and deliver the following **For each of the power systems you use, including the BQ24075:**
  - Schematics
  - Input voltage range
  - Output Voltage
  - Output Current
  - Please check that the device is in Digikey and use your Electrical Engineering intuition to not select an overkill design!
  - Your design will be saved on your TI account once you hit "Customize"

- If you are using LDOs, which are very easy to design, please provide a simple schematic and a MPN.

**Deliverables:**

**Complete schematic capture of all power circuitry -- charging & regulation.** It is not necessary to capture the power connections for every other IC (SAM W25, sensor, actuator). However, you must capture all of the power specific circuits -- battery charging and regulation. **Submit your files (power schematics, schematic library, and PCB library) using the Altium project packager, which will output a zip file of all source files.**